Study on the Possibility of using LLFP as Burnable Poison for Transmutation

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Transmutation of long-lived fission products is one of the key issues in development and utilization of nuclear power in the world. In the study underway we are trying to replace the burnable poison in LWR by a mixture of some LLFPs. Main fission product isotopes included in high level waste (HLW) with half life less than 15 years are: ^{85}Kr, ^{93m}Nb, ^{102}Rh, ^{106}Ru, ^{109}Cd, ^{113m}Cd, ^{125}Sb, ^{134}Cs, ^{146,147}Pm, ^{152,154,155}Eu, ^{171}Tm within 15 and 30 years are: ^{90}Sr, ^{137}Cs, ^{121m}Sn within 30 and 90 years is: ^{151}Sm, within 100 and 20000 years are: ^{94}Nb, ^{108m}Ag, ^{158}Tb, ^{166m}Ho and more than 20000 years are: ^{79}Se, ^{93}Zr, ^{94}Nb, ^{99}Tc, ^{107}Pd, ^{126}Sn, ^{129}I, ^{135}Cs. Our main objectives are: (1) to calculate the atomic density of each LLFP in the mixture with reactivity equivalent to the reactivity of boron used in LWR, (2) to calculate the absorbed neutrons in LLFPs as compared to burnable poison, (3) to calculate the transmutation rate and the change of reactivity. The advantage of using LLFPs is the closeness of neutron spectrum in burnable (LLFP) rods and fuel rods. In the calculation we use ENDF/B6 and JENDL-3.2 libraries. Preliminary calculation is promising and needs more elaborate calculations.

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